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Introduction

The purpose of this Glossary is to provide the reader with a quick refresher when he runs across key terms in the text. Pask's system is both novel and complex, and few people will remember all the nuances at a first reading — hence the need for a Glossary. The Glossary is not, however, a substitute for the text. No attempt has been made to give completely self-sufficient explanations (for that, after all, is the function of the main text). Nevertheless, some concessions have been made, usually by giving the general (ordinary language) meaning of a term before specifying Pask's precise usage. By this means it is hoped that the Glossary is something more than a closed system of lexical definitions.

The Glossary does have certain limitations. Firstly, it has not been tested on potential readers, either alone or in conjunction with the main text (it has been read by experts, which is quite another thing). So readers may, on occasion, discover that the Glossary does not quite meet their needs because possible sources of misunderstanding have not been adequately identified and debugged. Secondly, there are certain kinds of omission, for example, some terms have, on reflection, been left out; minor variations in term usage have been ignored; and no entailment structure for the system itself has been presented. Thirdly, there may be errors of commission — though a lot of hard work has been put in to reduce the chance of mistaken definitions. Fourthly, the presentation of terms is, regrettably, rather haphazard (no consistent rules for ordering multi-word terms have been used; you should find a term classified alphabetically under the most important word). Despite these reservations, I hope readers will find the Glossary of use as they work towards an understanding of Pask's system.

I am especially grateful for the comments of colleagues at Systems Research and IET; they have removed many inconsistencies and clarified obscurities. The final wording and the responsibility for any errors is mine, or course. I should be interested to receive any suggestions or comments on the Glossary that readers might care to make; if the book runs to

further editions, it may be possible to take account of such ideas in a revised version. To produce this Glossary has been a fascinating and demanding exercise. I shall feel well rewarded if it makes the work of an original and important thinker that much more accessible to the educated public.

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1.	Analogy (statement)	In general, A is to B as C is to D. Often A, B are in one universe of discourse and C, D in another.
	— analogy relation	Relation between relations specified in different domains by means of a mapping. Related relations may be specified as programmes or procedures.
	— analogy relation (other use)	Substructure, in pruned entailment mesh, that represents analogy.
2.	Behaviourist (formulation or version)	Methodology for constraining living organisms to fit standard experimental condition (q.v.).
3.	BOSS	Belief and opinion sampling system. Accepts confidence estimates ($0 \rightarrow 1$) from subjects faced with a set of exclusive alternatives. Automatically normalises estimates so that they add up to 1.
4.	CASTE	Course assembly system and tutorial environment. A system for exhibiting learning strategies and regulating uncertainty. A man-machine system for realising a restricted but non-trivial conversation.
5.	CET	Co-operative externalisation technique. In general, a way of bringing knowledge and understanding into the public arena. Here, a conversational procedure (used in CASTE) for exhibiting learning and problem-solving strategies as observable behaviours.
6.	Classical paradigm	The standard experimental condition (q. v.) or its behaviouristic version.
7.	Concept	A procedure for bringing about a relation. *Not* a set of things.
8.	Conjunctive substructure	Part of pruned entailment mesh. Means there is only one permitted way of constructing (coming to know) relation X from subordinate relations (cf. disjunctive substructure).
9.	Consistency condition	In general, the requirement that systems should be internally consistent. Here, the same topic relation always has the same name and a different topic relation has a different name.
10.	Conversation, strict	Takes place in CET and CASTE (q.v.). All topics belong to a fixed domain. Understandings are recognised and used to demark occasions which are placed in order.
11.	Disjunctive substructure	Part of pruned entailment mesh. Means there is more than one permitted way of constructing relation X. (cf. conjunctive substructure).
12.	Domain (conversational)	In general, what the conversation is about; the universe of discourse. Here characterised by the entailment structure and the task structure (q.v.).
13.	Entailment	In speaking of what may be learned (i.e. how one topic relation may be legally derived from

another) cognitive operations are imaged by formal relational operators. It is frequently useful to gloss the distinctions and speak of any or all legal derivations as an "entailment". Thus X entails Y if X is legally derivable (in whole or in part) from Y.

An entailment structure is used to represent what may be learned and how it may legally be learned. It is a graph in which nodes stand for topic relations and arcs for entailments and is constructed in stages, as below. The stages are (1) relational network, (2) entailment network, (3) entailment mesh, (4) cyclic entailment mesh, (5) pruned entailment mesh, (6) entailment structure.

— entailment chain — Sequence of arcs pointing in same direction, outgoing from node x and ingoing to node y.

— entailment mesh — Third stage in development of an entailment structure. Stipulates what may be known, hence a "permission-giving" structure.

— entailment mesh (cyclic) — The fourth stage in the development of an entailment structure. Here, all nodes are either connected in cyclic entailment chains, or they are primitives.

— entailment mesh (pruned) — Fifth stage in development of an entailment structure. Formed by pruning re-entrant loops thus: cut arcs outgoing from head, and arcs ingoing to primitives and the level above primitives, and arcs outgoing from any node to outside network. This removes all

internal cycles with the exception of analogies. The only descriptors left are subordinate—superordinate and analogy. Nodes are place holders for topic relations.

— entailment network — The second stage in the development of an entailment structure. Derived from relational network by removing labels and representing operators as distinguished nodes. Though isomorphic with the relational network, the arcs now stand only for entailment.

— entailment structure — The final product with which the student interacts. It is the pruned entailment mesh with L descriptions added.

14. Experimental contract — Refers to the normative paradigm (q.v.). In normative experiments the behaviour of the participant is controlled by an agreement negotiated in metalanguage L* (q.v.); this is the experimental contract. In the classical paradigm (cf.) one might talk about "giving instructions". But, if so, the mechanism of giving and interpreting the instructions is not made explicit, for it is extra-theoretical. The effect of the instructions is taken on a par with any other constraint introduced to maintain constant and repeatable conditions (for example, level of illumination, preconditioning or starvation prior to the experiment).

15. Free learning — Experimental situation where subjects are free to choose pathway. Contrasted with situa-

	tions where pathway through structure is prescribed.
16. Head	Node or nodes at apex of pruned entailment structure (q.v.).
17. Holist	A basic category of learning style. In general holists learn, remember and recapitulate as a whole (in terms of "higher order relations"). Identified (1) by forming multi-predicate hypotheses in the taxonomy experiments, (2) by the pattern (number, distribution and sequence) of markers in CASTE.
— irredundant holist	Deals only with strictly relevant considerations.
— redundant holist	Includes logically redundant (but to him psychologically necessary) material when given the option.
18. Index	In general, a number; usually giving the value of a parameter in the CASTE system.
— index of correct belief (θ^*)	Scoring procedure following student's estimation of uncertainty in BOSS.
— index of difficulty (η)	The degree of difficulty of the task in an adaptive teaching situation.
— index of information (J)	Observer's view of subject's uncertainty reduction.
— index of problem simplification	An estimation by the observer of the intrinsic difficulty of a problem.
— index of performance (ρ)	An index of the subject's behaviour, for example, correct response frequency.
— index of uncertainty (I)	Subject's uncertainty about solution of problem, e.g. the multiple-choice questions in BOSS.

— index of structural uncertainty (I^*)	An estimate by observer of the maximum uncertainty a subject might experience.
— other uses of "Index"	(1) Index (i) of a topic relation (R_i); the list position or mechanically recognised name of a topic relation. (2) As a subscript; the index of an element in a set or the index (set) of the coordinates of a Cartesian product of set.
19. Interface	Separates A (human) from B (human or machine). Serves (1) as their communication medium, (2) place where transactions may be recorded.
20. Interrogator (Analyst)	Translates loose natural expressions about topics into precise relations expressed in L^*.
21. Introspection	Conversation between two P individuals executed in one M individual (e.g. a brain).
22. Language	In general, language is functionally stratified. That is, an observer can distinguish different levels in ordinary language communication. We can say things, and also talk about the saying. For example, "Let's now discuss this" or "Let this word mean such and such" or "I'll ask the questions and you give the answers". Language may also be formally stratified for experimental purposes.
— natural language (L^+)	The unrestricted language used between a source and the interrogator-analyst. Not subject to logical scrutiny, hence differs from L^*.

— object language (L)	Used inside the CASTE system (cf. metalanguage L*, used outside). Has some of the qualities of natural language, for example, it allows commands, questions, ostension and predication. Stratified into an upper level (L^1) and a lower level (L^0), as below.
— object language (L^1)	Used for commands to learn and requests for explanation.
— object language (L^0)	Used for commands and questions about the building of models. The construction of models brings about relations and amounts to a practical explanation.
— observational metalanguage (L*)	For talking about experiments, describing the system, prescribing actions to pose and test hypotheses; and for negotiating the experimental contract.
23. Learning strategy	Generally, the way a student chooses to learn. Assumed that strategies can be classified into a limited number of learning styles, for example, holist and serialist (q.v.).
24. Macrotheory	Described by statistical variables, e.g. indices of subject's uncertainty and indices of correct belief (cf. microtheory).
25. Marker predicate	Indicates current status of nodes in entailment structure, (for example, "understood" or "being aimed for" or "member of set of topics that student is currently engaged in learning").
26. Microtheory	Expressed in terms of mental events, linguistic transactions, underlying cognitive mechanism.

27. Mechanical individual	Generally, the physical organisation which executes the procedures which are concepts and memories. Formally, a mechanically or biologically stable self-reproducing entity (cf. psychological individual).
28. Memory	Procedure for the reproduction of a concept. *Not* a store of data.
29. Modelling facility	Generally, if learning involves real-world activities plus explanations, then the modelling facility provides for simulation of the real-world activities. Here it refers to the laboratory aspects of CASTE, for example STATLAB (q.v.). Formally, a modelling facility is an environment for a strict conversation where topic relations are brought about by model-building activities.
30. Nodes	In graph theory, one of the two basic elements (nodes, arcs). Here nodes indicate the position of concepts within an entailment structure.
31. Normative paradigm	Experimenter negociates an experimental contact in metalanguage (L^*); the participant agrees to speak an object language (L) throughout the experiment. See psychological experiment, and contrast classical paradigm.
32. Occasion (conversational)	Characterised by a recognisable linguistic event, i.e. the understanding of some topic relation in the domain.
33. Performance strategy	The subject's output, e.g., how he explains on a modelling facility. As learning strategy is to

entailment structure, so performance strategy is to task structure (q.v.).

34. Place holder — Blank and labelled node which may be filled if the student elects to work on it.

35. Primitives — Nodes in the entailment mesh that are devoid of incoming arcs.

36. Problem — Here it means the L* description of a need to bring about a relation. In general, a task situation.

37. Procedure — A program, usually a non deterministic program or a Fuzzy Algorithm, compiled for execution in a suitable L processor. Most often, the L processor is a brain; it may also be a collection of interacting brains (as in a small group) or a brain and a machine to augment it.

38. Psychological experiment — A conversation between two or more participants on a series of topics that form a conversational domain. One participant is the subject, the other may be a machine or a person acting as the experimenter's agent. This definition forms part of the normative paradigm (q.v.).

39. Psychological individual — The set of procedures which may be executed in a mechanical individual (q.v.). Thus, a psychological individual is a coherent cognitive organisation consisting of a class of self-reproducing memories. Note the progression: procedures→concepts→memories → psychological individual.

40. Relations — In general, means that things or ideas are found associated together. Here, the basic knowables and do-ables are relations (i.e. concepts, q.v.); and both the nodes and arcs of networks stand for relations.

— relational network — The first stage in the development of an entailment structure (q.v.). It is a finite directed graph with nodes that stand for topic relations cited by a source. The labelled directed arcs represent paths whereby (through the application of relational operators, q.v.) one relation is derivable from one or more other relations. Entailment network is the next stage (q.v.).

— relational operator — Relations which act on other relations (see relational network). Some of these operators are of basic logical or set-theoretic form (*and*, *or*, *not*, etc.) others are not (*projection*, *composition*, *restriction*, etc.). In the system, all relations between topic relations can be expressed by some ordered combination of these operators. Combinations of operators represent (in L* dialogue) and perform the same transformations as the cognitive operations a student is assumed to have in his mental repertoire. But they are not assumed to be identical with these cognitive operations.

41. Serialist — One of the basic learning styles (cf. holist). Serialists learn, remember and recapitulate a body

of information in small, well-defined and sequentially-ordered segments. Identified by distribution of markers in CASTE and hypotheses posed in taxonomy experiment.

42. Source — Subject-matter expert. Constructs domain for the conversational interactions.

43. Sprout — Growing point of a domain (strict conversation) as generated by source.

44. SST — Steady state technique. In a normative experiment, maintains a steady level of performance by the subject.

— SST control system — A device that interacts with a subject who is performing a task. Maintains a constant level of performance by posing problems of appropriate difficulty.

45. Standard experimental condition (SEC) — A methodology for experiments on living organisms. Derived from physical science methods, and contrasted with the normative paradigm (q.v.). In SEC there is a clear distinction between observer and organism (or subject); concepts such as "contract" or "agreement" are not thought appropriate. Variables often changed singly, and effects noted. Runs into trouble when variables are strongly related and organism changes or adapts while experiment is in progress.

46. STATLAB — Simulates real-world statistical experiments. One type of modelling facility.

47. Task relation — Operations subject performs to learn a topic.

48. Task structure — Represents all the ways a subject may legally model, depict or non-verbally explain a topic relation. (see performance strategy)

— TS_i — Task structure attached to node i in entailment structure (q.v.).

— TS — Union of task structures attached to every node in entailment structure.

49. Teachback — Learner demonstrates his understanding by explaining the subject to the experimenter. Externalises concept reproduction; allows explanations to be matched with re-explanation.

50. Teaching — Control or regulation of a learning process.

51. Token — Sits on a place holder, usually a node in a CASTE entailment structure, to indicate status of place holder (node); for example, that topic is being/has been worked on by subject.

52. Topic — Used in two senses: (1) a relation in the form of a labelled node (i.e., a source cites topics, and they are represented as relations), (2) the whole domain of a conversation.

— topic relation — Variation used to emphasise that topics are relations (q.v.).

53. TOTE unit — Stands for "Test, Operate, Test, Exit" from "Plans and the Structure of Behaviour" by Miller, Galanter and Pribam. A basic building block for modelling cognitive systems. Represents feedback and goal-directed action.

54. Understanding — Understanding of a topic relation by two participants occurs when they agree that their memories are equivalent (through teach-back). It is usually detected by explanation of topic relation and, on some occasions, a justification in terms of how the explanation was built up.

55. Versatility — Ability to change learning strategy (q.v.) in light of information gained. Depends on rate at which cognitive fixity develops in a tutorial conversation.